Docket No. 650-U
FLEISCHER-LAU CASE

CLM PTO

WHAT IS CLAIMED IS:

[1. A method of recovering, at a destination node of a packet-based telecommunications network, the timing clock of a service input at a source node of said packet-based telecommunications network, the destination node and the source node having a common network clock, comprising the steps of:

(a) at the source node, dividing the timing clock of the service input by a factor of an integer N to form residual time stamp (RTS) periods;

(b) at the source node, counting the network clock cycles modulo 2^P, where 2^P is less than the number of network clock cycles within an RTS period and P is chosen so that the 2^P counts uniquely and unambiguously represent the range of possible network clock cycles within an RTS period;

(c) transmitting from the source node to the destination node an RTS at the end of each RTS period that is equal to the modulo 2^P count of network clock cycles at that time;

(d) determining from the RTSs received at the destination node, the number of network clock cycles in each RTS period;

(e) generating a pulse signal from the network clock at the destination node in which the period between each pulse in the pulse signal equals the determined number of network clock cycles in the corresponding RTS period; and

(f) multiplying the frequency of the pulse signal generated in step (e) by the same factor of an integer N used in step (a) to recover the timing clock of the service input.]

[2. The method of claim 1 wherein the network clock frequency is less than or equal to twice the service clock frequency.]

[3. A method of recovering, at a destination node of a packet-based telecommunications network, the timing clock of a service input at a source node of said packet-based telecommunications network, the destination node and the source node having a common network clock, comprising the steps of:

(a) at the source node, dividing the timing clock of the service input by a factor of an integer N to form residual time stamp (RTS) periods;

(b) at the source node, dividing the network clock by a rational factor to form a derived network clock;

(c) at the source node, counting the derived network clock cycles modulo 2^P, where 2^P is less than the number of derived network clock cycles within an RTS period and P is chosen so that the 2^P counts uniquely and unambiguously represent the range of possible derived network clock cycles within an RTS period;

(d) transmitting from the source node to the destination node an RTS at the end of each RTS period that is equal to the modulo 2^P count of derived network clock cycles at that time;

(e) at the destination node dividing the network clock by the same rational factor used at the source node to form a derived network clock equal to the derived network clock at the source node;

(f) determining from the RTSs received at the destination node, the number of derived network clock cycles in each RTS period;

(g) generating a pulse signal from the derived network clock at the destination node in which the period between each pulse in the pulse signal equals the determined number of derived network clock cycles in the corresponding RTS period; and

(h) multiplying the frequency of the pulse signal generated in step (g) by the same factor of an integer N used in step (a) to recover the timing clock of the service input.]

[4. The method of claim 3 wherein the derived network clock frequency is less than or equal to twice the service clock frequency.]

[5. Apparatus for recovering, at a destination node of a packet-based telecommunications network, the timing clock of a service input at a source node of said packet-based telecommunications network, the destination node and the source node having a common network clock, comprising at the source node:

dividing means for dividing the timing clock of the service input by a factor of an integer N to form residual time stamp (RTS) periods;

counting means connected to the network clock for counting network clock cycles modulo 2^P, where 2^P is less than the number of network clock cycles within an RTS period and P is chosen so that the 2^P counts uniquely and unambiguously represent the range of possible network clock cycles within an RTS period; and

transmitting means, responsive to the RTS periods formed by said dividing means and the count of said counting means, for transmitting over the telecommunications network an RTS at the end of each RTS period that is equal to the modulo 2^P count of network clock cycles at that time;

and comprising at the destination node:

receiving means for receiving the RTSs transmitted over the telecommunications network by said transmitting means;

converting means responsive to the received RTSs and the network clock for converting the received RTSs into a pulse signal in which the periods between pulses are determined from the numbers of network clock cycles associated with the counts of network clock cycles within said RTS periods; and

means for multiplying the frequency of the pulse signal generated by said converting means by the same factor of an integer N used in said dividing means for recovering the timing clock of the service input.]

[6. Apparatus in accordance with claim 5 wherein the network clock frequency is less than or equal to twice the service clock frequency.]

[7. Apparatus in accordance with claim 5 wherein said converting means comprises:

means for sequentially storing the received RTSs;

means for counting network clock cycles modulo 2^P;

comparing means for comparing the modulo 2^P count of network clock cycles with a stored RTS and for generating a pulse each time the count of network clock cycles matches the RTS; and

gating means for gating to said multiplying means, for each sequentially received and stored RTS, the pulse produced by said comparing means that occurs after the counting means counts, starting-in-time from the previous gated pulse, a number of network clock cycles that is greater than a predetermined minimum absolute number of network clock cycles that can occur within any RTS period.]

[8. Apparatus for recovering, at a destination node of a packet-based telecommunications network, the timing clock of a service input at a source node of said packet-based telecommunications network, the destination node and the source node having a common network clock, comprising at the source node:

first dividing means for dividing the timing clock of the service input by a factor of an integer N to form residual time stamp (RTS) periods;

second dividing means for dividing the network clock by a rational factor to form a derived network clock;

counting means connected to the network clock for counting derived network clock cycles modulo 2^P, where 2^P is less than the number of derived network clock cycles within an RTS period and P is chosen so that the 2^P counts uniquely and unambiguously represent the range of possible derived network clock cycles within an RTS period; and

transmitting means, responsive to the RTS periods formed by said first dividing means and the count of said counting means, for transmitting over the telecommunications network an RTS at the

end of each RTS period that is equal to the modulo 2^P count of derived network clock cycles at that time;

and comprising at the destination node:

receiving means for receiving the RTSs transmitted over the telecommunications network by said transmitting means;

means for dividing the network clock by the same rational factor used at the source node to form a derived network clock;

converting means responsive to the received RTSs and the derived network clock for converting the received RTSs into a pulse signal in which the periods between pulses are determined from the numbers of derived network clock cycles associated with the counts of derived network clock cycles within said RTS periods; and

means for multiplying the frequency of the pulse signal generated by said converting means by the same factor of an integer N used in said first dividing means for recovering the timing clock of the service input.]

[9. Apparatus in accordance with claim 8 wherein the derived network clock frequency is less than or equal to twice service clock frequency.]

[10. Apparatus in accordance with claim 8 wherein said converting means comprises:

means for sequentially storing the received RTSs;

means for counting derived network clock cycles modulo 2^P;

comparing means for comparing the modulo 2^P count of derived network clock cycles with a stored RTS and for generating a pulse each time the count of derived network clock cycles matches the RTS; and

gating means for gating to said multiplying means, for each sequentially received and stored RTS, the pulse produced by said comparing means that occurs after the counting means counts, starting-in-time from the previous gated pulse, a number of derived network clock cycles that is greater than a predetermined minimum absolute number of derived network clock cycles that can occur within any RTS period.]

LAW OFFICES
FINNEGAN, HENDERSON, FARABOW, GARRETT, & DUNNER, L.L.P.
1300 I STREET, N. W.

-- ~~33~~. A method for representing a timing clock of a service input signal at a source node of a packet-based communications network including a network clock, the method comprising the steps of:

defining a number of time intervals, each represented by a fixed number of timing clock cycles of the service input signal;

determining a number of network clock cycles respectively within each of the time intervals;

determining a modulo 2^P value of each of the determined number of network clock cycles, wherein 2^P represents a range of tolerance in the timing clock of the service input signal; and

transmitting each of the determined modulo 2^P values at the end of each of the time intervals respectively.

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12 ~~34.~~ A method for representing a timing clock of a service input signal at a source node of a packet-based communications network including a network clock, the method comprising the steps of:

defining a number of time intervals each represented by a fixed number of timing clock cycles of the service input signal;

determining a number of network clock cycles respectively within each of the time intervals;

determining a modulo 2^P value of each of the determined number of network clock cycles, wherein 2^P represents a range of possible deviations in the number of network clock cycles within each of the time intervals; and

transmitting each of the determined modulo 2^P values at the end of each of the time intervals respectively.

13 ~~35.~~ A method for recovering a timing clock of a service input signal at a destination node of a packet-based communications network including a network clock, the method comprising, the steps of:

receiving a residual time stamp that represents a modulo 2^P value of a number of network clock cycles in a time interval defined by a fixed number of timing clock cycles of the service input signal, wherein 2^P represents a range of tolerance in the timing clock of the service input signal;

determining, from the residual time stamp and the network clock cycles, the time interval; and

recovering the timing clock of the service input signal based on the determined time interval and the fixed number of timing clock cycles.

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B1 Cont.

14 ~~30.~~ A method for recovering a timing clock of a service input signal at a destination node of a packet-based communications network including a network clock, the method comprising the steps of:

receiving a residual time stamp that represents a modulo 2^P value of a number of network clock cycles in a time interval defined by a fixed number of timing clock cycles of the service input signal, wherein 2^P represents a range of possible deviations in the number of network clock cycles within the time interval;

determining, from the residual time stamp and the network clock cycles, the time interval; and

recovering the timing clock of the service input signal based on the determined time interval and the fixed number of timing clock cycles.--